

(1603—1867), d. h. während der das Reich faktisch regierenden Schogune aus dem Hause Tokugawa in Edo (Tokyo), die Entwicklung der Seidenraupenkultur in der nordwestlichen Kanto-Ebene. Die größeren Siedlungsdichten am Fuße der Vulkane Harunasan und Akagisan im Regierungsbezirk Gumma sprechen also davon, daß hier die Inwertsetzung des Terrassenlandes früher erfolgte und die kulturlandschaftliche Reifung des Raums schon weiter fortschreiten konnte als unmittelbar südlich und vor allem östlich davon. Der Unterschied in der Bevölkerungsdichte, wie er zwischen der nordwestlichen und östlichen Kanto-Ebene besteht, ist also in weitgehendem Maße nichts anderes als die Dokumentierung eines geschichtlichen Vorgangs im räumlichen Erscheinungsbild.

Der Sog des Küstenstreifens, der die Bevölkerungsdichte mitbestimmende Wechsel von Alluvial- und Diluvialflächen und die sich heute noch landschaftlich auswirkenden historischen Momente: diese Dreieit ist für alle größeren und kleineren ans Meer grenzenden Ebenen der Hauptschlüssel für die Erklärung der Bevölkerungsverteilung auf ihnen.

Auch in der Verteilung der Bevölkerung über das ganze Land hinweg, das zeigt die neue Dichtekarte deutlich, spiegeln sich die physische Natur und die Gesamtheit der Antworten, die der Mensch auf diese Natur gab und noch gibt. Die Erklärung der Bevölkerungsverteilung über das ganze Inselreich liegt letzthin im Inhalt dessen, was eine umfassende Landeskunde ausmacht.

Das hier zunächst nur beschriebene Strukturbild wird sich in den nächsten Jahren kaum ändern. Von den 5,9 Millionen Menschen, um die Japan 1950 bis 1955 wuchs, leben 70% in den Regierungsbezirken, zu denen die Städte Tokyo, Yokohama, Nagoya, Kyoto, Osaka und Kobe rechnen, d. h. „Die Großen Sechs“. Außer ihnen erfuhren nur noch Fukuoka und Teile Hokkaidos erhebliche Zunahme, die Nordinsel infolge der Durchführung eines besonderen Entwicklungsprogrammes. Die Zunahmen in den Städten beruhen auf Zuwanderung. Die Verstädterung ist in Japan eine „Vergrößtädterung“, und jenseits der Tokai-Sanyo-Region befinden sich viele Städte im Rückgang. Es ist wahrscheinlich, daß sich die in den Leitsätzen 1—5 herausgearbeiteten Kontraste noch verstärken werden. Über den Bevölkerungsrückgang der Städte und ganzer Landkreise (gun) jenseits der Region des pulsierenden Lebens täuscht auch die Vielzahl der durch das Eingemeindungsgesetz von 1953 entstandenen neuen Mittel- und Großstädte (shi) nicht hinweg<sup>6)</sup>. Selbst unter den zentralen Orten höheren Grades zeigen 20% eine Bevölkerungsabnahme. „The decrease in the population of so many places has never taken place before<sup>7)</sup>.“ Die Ursache sehen Minoru TACHI und seine Mitarbeiter nicht nur im Geburtenrückgang, sondern vor allem in der überstarken Binnenwanderung in Richtung auf die „Großen Sechs“.

## POPULATION DENSITY OF JAPAN BY LAND FORM DIVISION

REIKO KAWAI

with 2 sheets of map and a table<sup>1)</sup>

Population density maps published in Japan usually were made on the basis of the administrative units of Ken (Prefecture), Gun (county), Shi (city), Machi (town) and Mura<sup>2)</sup> (village). By this method we regard the population distribution as homogeneous in one unit, and the real differentiation of distribution cannot be represented by the map. In Japan, the minimum units of the report of population census are shi, machi and mura, but the boundary of shi is not the same as that of urban area; shi include rural area, too, around a nucleus of urban area. Even the population distribution of mura resembles that of the „Haufendorf“ or „Strassendorf“. Mura situated in the center of alluvial plains or plateaus are rather few. There are many cases in which mura spread their boundaries even to the top of mountains or ridges, and settlements occupy narrow valley plains or plains along the coasts, the rest is an unsettled vast forest area. We cannot give a clear definition of the character of machi; some of them resemble shi, others mura. Recently amalgamation of machi and mura has taken place<sup>3)</sup>, the number of shi increasing from 248 to 491 and machi decreasing from 1877 to 1864. Mura also decreased from 8,289 to 2,458. Following this, administrative units became larger, and new cities were born though they have only 30,000 persons at the lowest level, actual urban areas are very small and great parts of such administrative units areas or unsettled areas. If we calculate the population density according to those units the density becomes unusually high because of urban population. On the contrary, density of urban areas appears lower than the real density. An order to correct this, the Statistical Bureau is preparing to make the next population census of 1960 following the „census tract“ which separates urban areas from shi.

From this point of view, the dot map is better than the density map. The Geographical Institute published „Population Distribution, by Dot Method 1 : 2,000,000“ using the population census 1950, and then „Population Distribution and Density 1 : 800,000“ by the census of 1955. The latter is an innovation representing both absolute dot map and relative density map on one sheet. The relative density maps excel in that they can be compared with each other, and so we intend to make the population density map by geographically rational units. Among the many elements of natural division of unit, land form is connected closely to human settlement. By „Population Density Map by Land Form Division“ it becomes clear that the differentiation of population density on the same land enables us to find other elements such

<sup>1)</sup> Die Arbeit wurde unter der wissenschaftlichen Leitung von Prof. TAKAMASA NAKANO durchgeführt.

<sup>2)</sup> Im folgenden Text werden shi, machi und mura, dem japanischen Brauch entsprechend, mit kleinen Anfangsbuchstaben geschrieben.

<sup>3)</sup> Vgl. hierzu Erdkunde, Bd. XI, Lfg. 1, 1957, S. 64—69.

<sup>6)</sup> Vgl. hierzu den Beitrag des Verf. in Bd. XI, 1957, S. 64 ff. dieser Zeitschrift.

<sup>7)</sup> TACHI, M., UEDA, M., und HAMA, H.: Regional Characteristics of Population in Japan. In: Proc. of IGU Regional Conference in Japan 1957. Tokyo 1959. S. 480—484.

as history development, land use, social, historical or economical elements affecting it. Until now, it was difficult to secure an exact statement in figures of population density of any plain or mountain. The tabulation is not by natural units today, so the only means is to calculate the census according to our purpose.

Now we are making this map using the population census of 1955. It will be published at the beginning of 1959 in the scale 1 : 800,000 consisting of 3 sheets, printed in 7 colours, and an index which arranges the numbers and names of land form units all over the country. Here we represent as a sample, Central Japan.

#### *Division of Land Form*

It is not the classification of land form surface (plane), but the division of land form units. In mountain areas it includes valley floors dissecting the mountains. The boundaries of land form division are not geologically or geomorphologically important lines but they divide the land form in units of human settlement. Flat land, relief, height above sea level, relative heights, inclination, degree of dissection by valley and utilization of land, paddy field, upland field or forest are important elements to divide the land form units. Of course the lines of these units have no relation to the administrative units. We used the formerly made land form division map, air-photographs, topographic maps and many geological reports.

As well as dividing the unit we divide the type of land form in order to clarify the relation of population distribution in each land form unit. The division of land form type consists of

plain	{	lowland upland
mountain land	{	hill land mountain volcanic area

The definition are as follows:

Lowland; surface mainly consists of plain, valley plain, fan, delta, reclaimed and, peat bog land, sand dune, tidal flat, and slightly elevated alluvial lowland, its relative height above valley floor less than 10 m (fan, terrace).

Upland; mainly diluvial upland, flat land, bordered lowland with terrace scarp more than 10 m, river terrace, coastal terrace, dissected fan, dissected delta and coastal plain.

Hill land; in the classification of mountain land, relative height above low land is less than 300 m. It mainly consists of layers of Tertiary Period, and ridges are even in height.

Mountain; to mountain land belongs neither hill land nor volcanic mountain.

Volcanic area; in classification of mountain land initial form consists of extrusive body or volcanic

scoria, volcanic flank or skirts, lava plateau, Karst plateau, land form due to lava flow or volcanic mud flow.

These 5 kinds of land form types are represented by symbols in each unit of land form division.

#### *Limits of areas of land form divisions*

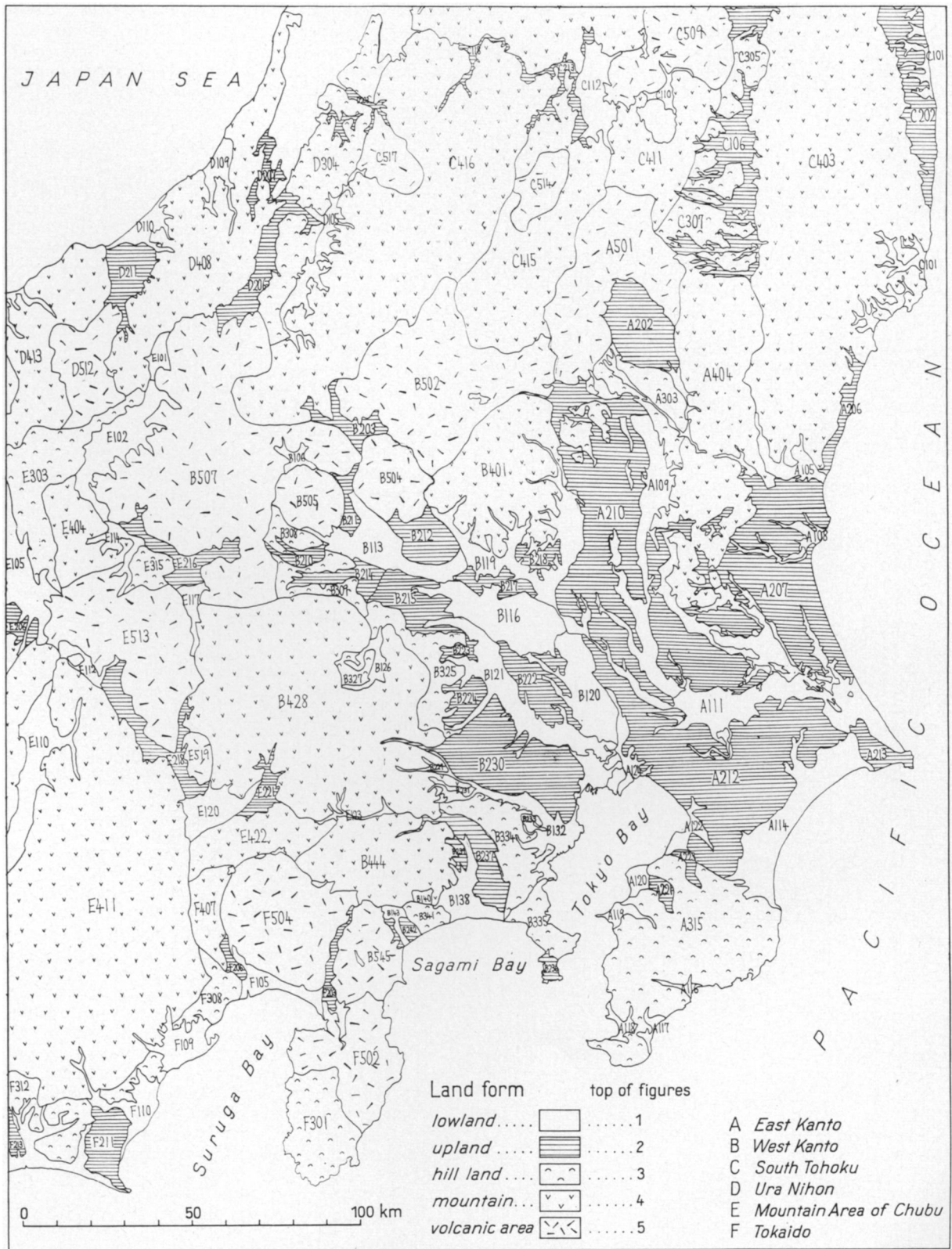
Considering the expressive ability of this map, a small scale map of 1 : 800,000, the smallest areas of division are determined. Population distribution is varied in plains, so it is better if the area of a unit is small. On the contrary, in mountains, it might be larger; even if divided smaller, the density does not vary so much. The smallest unit is in plain 20 km<sup>2</sup>, in mountain 100 km<sup>2</sup>. If smaller areas which have the same character exist apart from the main division, we do not abandon more than 4 km<sup>2</sup> exceptionally, and if the distance apart of each unit is less than 1 km, we join them in one circle. In which division, a unit less than above mentioned smallest unit is to belong is determined by considering its size, character and origin of neighbouring units, and other things being equal we place it in a lower land form division. Areas of each unit are tabulated. First the administrative areas of shi, machi or mura whose boundaries are completely included in one land form unit, next, the areas of shi, machi or mura whose boundaries extend over more than two units, are tabulated after dividing their administrative areas by mesh method.

Population density is calculated only by rural population which is connected closely with the land, and urban population is treated in another way. Urban population concentrates in a narrow area making its own function, the relationship to the land is rather indirect. Population density all over the unit becomes unusually high if urban population of cities or towns forming the nucleus in the land form division are used as basis of calculation. It was thought, then, advisable to take away urban population of cities or towns from the whole population of land form division and represent the urban area in its position in spite of the boundary of division. The question is the urban population above what level. We cannot simply determine the population of shi as urban population and mura as rural population, because the boundary of shi is far beyond that of urban area and includes rural population, too.

Mura has not only primary industry but also of secondary or tertiary industry engaged in some work of shop, school, office and so on, being annexed necessarily in the place that people assemble. We cannot recognize those people as urban population even when existing in small settlements.

Therefore we take away urban population from shi and machi by the following method of computation:

$$\text{Urban population} = \frac{\text{all industrial population} - (\text{agriculture} + \text{forestry} + \text{fishing} + \text{mining})}{\text{all industrial population}} \times 100$$



*Map. 1: Mittel-Honshū: Land form divisions*

<i>Population Density by land form division</i> (1950 population census, Statistical Bureau)				Number of unit	Name of division	Land form	Population density per km <sup>2</sup>
Number of unit	Name of division	Land form	Population density per km <sup>2</sup>				
<i>A East Kantô</i>							
A 501*)	Nasu	Volcano	37	B 231	Hachiôji	Plateau	730
A 202	Nasu	Plateau	211	B 132	Tamagawa	Plain	620
A 303	Yaita	Hill land	137	B 233	Tama	Plateau	325
A 404	Yamigo	Mountain	116	B 334	Tama	Hill land	316
A 105	Kujigawa	Plain	520	B 335	Miura	Hill land	286
A 206	Hitachi	Plateau	748	B 236	Miura	Plateau	561
A 207	Jôso	Plateau	295	B 237	Sagamihara	Plateau	607
A 108	Nakagawa	Plain	424	B 138	Sagamihara	Plain	925
A 109	Kinugawa	Plain	435	B 239	West Sagamihara	Plateau	530
A 210	Yûki	Plateau	362	B 140	Hatano	Basin	719
A 111	Simotone	Plain	330	B 341	Oiso	Hill land	606
A 212	Simousa	Plateau	321	B 242	Odawara	Plateau	477
A 213	Choshi	Plateau	346	B 143	Sakawagawa	Plain	670
A 114	Kujukuri	Plain	466	B 444	Tanzawa	Mountain	108
A 315	Bôsô	Hill land	218	B 545	Hakone	Volcano	148
A 116	Kamogawa	Plain	245	<i>C South Toboku</i>			
A 117	Chikura	Plain	374	C 101	Abukuma	Coastal Plain	537
A 118	Tateyama	Plain	316	C 202	Abukuma	Plateau	186
A 119	Futtsu	Plain	659	C 403	Abukuma	Mountain	110
A 120	Kisarazu	Plain	504	C 104	Fukushima	Basin	474
A 221	Kisarazu	Plateau	232	C 305	Nihonmatsu	Hill land	118
A 122	Chiba	Plain	551	C 106	Kôriyama	Basin	400
A 223	Chiba	Plateau	362	C 307	Shirakawa	Hill land	81
A 124	Tôkatsu	Plain	757	C 508	Zaô	Volcano	19
				C 509	Bandai	Volcano	65
				C 110	Inawashiro	Basin	447
				C 411	Aizu	Mountain	54
				C 112	Aizu	Basin	416
				C 213	Aizu	Plateau	280
				C 514	Hakushiyama	Volcano	31
				C 415	Taishaku	Mountain	25
				C 416	Jôetsu	Mountain	17
				C 517	Sumonyama	Volcano	9
				C 218	Tsukawa	Plateau	234
				C 419	Iide	Mountain	29
				C 420	Asahi	Mountain	42
				<i>D Ura Nihon</i>			
				D 201	Iwafune	Plateau	50
				D 102	Nigata	Plain	401
				D 203	South Kanbara	Plateau	198
				D 304	Uonuma	Hill land	124
				D 105	Muikamachi	Basin	310
				D 206	Tôkamachi	Basin	300
				D 207	Ojiza	Plateau	365
				D 408	East Kubiki	Mountain	136
				D 109	Kashiwazaki	Plain	454
				D 110	Takada	Plain	475
				D 211	Takada	Plateau	359
				D 512	Myoko	Volcano	78
				D 413	West Kubiki	Mountain	71
				D 114	Itoigawa	Plain	348
				<i>E Mountain Area of Chubu</i>			
				E 101	Iiyama	Basin	421
				E 102	Nagano	Plain	640
				E 303	Saikawa	Hill land	160
				E 404	Chikuma	Mountain	116
				E 105	Matsumoto	Plain	378
				E 206	Matsumoto	Plateau	345
				E 407	Hida	Mountain	24
				E 108	Kiso	Valley	166
				E 509	Kiso	Mountain	58
				E 110	Ina	Basin	292
				E 411	Akaishi	Mountain	44
				E 112	Suwa	Basin	577

\*) Der große Buchstabe bezeichnet die Großlandschaft, die erste Stelle der Zahl benennt den Typ der Landform-Einheit. Es bedeutet: 1 = lowland, 2 = upland, 3 = hill land, 4 = mountain, 5 = volcanic area.  
A 122 ist z. B. zu lesen: Ost-Kanto, Tiefland, Teil-landschaft 22.

Number of unit	Name of division	Land form	Population density per km <sup>2</sup>
E 513	Yatsugatake	Volcano	63
E 114	Ueda	Basin	572
E 315	Saku	Hill land	259
E 216	Saku	Plateau	473
E 117	Nozawa	Plain	660
E 218	Fujimi	Plateau	370
E 519	Kayagatake	Volcano	75
E 120	Kōfu	Basin	845
E 221	Katsunuma	Plateau	729
E 422	Misaka	Mountain	200
E 123	Katsuragawa	Valley	908

#### F Tokaido

F 301	Izu	Peninsula	175
F 502	Amagi	Volcano	153
F 203	Gotenba	Plateau	847
F 504	Fuji	Volcano	92
F 105	Numazu	Plain	890
F 206	Fujimiya	Plateau	493
F 407	Tenshu	Mountain	78
F 308	Shizuoka	Hill land	297
F 109	Shizuoka	Plain	638
F 110	Oigawa	Plain	699
F 211	Makinohara	Plateau	405
F 312	Enshu	Hill land	268
F 213	Iwatahara	Plateau	408
F 114	Enshu	Plain	680
F 215	Mikatagahara	Plateau	491

But in the case in which mining population occupies more than 10% of the industrial population, and fishing population occupies more than 20%, we do not add in the above (—). The former were 10 shi, the latter were 20 machi in 1950. Shi and machi which have more than 2,000 persons or urban population by this method of computation, must take away their real urban population from the population of division. It shows that all of the 248 shi and 591 machi (about  $\frac{1}{3}$  of the figure in 1877) have more than 2,000 of urban population by 1950 census. The reason why we divide by 2,000 is that the minimum area of division is 20 km<sup>2</sup> and if a small town exists in it, the density per 1 km<sup>2</sup> will be up 100, one grade. The limit of dividing urban population has to be either a low limit of 2,000 or 500,000 at the high limit, if not, it becomes impossible to compare it with rural density of each division whether it includes a city near the limit or not.

Number of shi and machi by size groups (census 1950):

Size group	Number of machi	Shi
2,001— 20,000	573	9
20,001— 50,000	18	128
50,001— 100,000		63
100,001— 200,000		31
200,001— 500,000		11
500,001—1,000,000		3
1,000,001 <		3
total	591	248

The average percentage of urban population to all population of shi and machi which have urban population of more than 2,000 is 82%, and in the

case of great cities above 200,000 (17 cities), the average becomes 95%. We can add the following facts: 46,5% of population for all Japan live in those 248 shi and 591 machi which constitute only 9% of area for all Japan. Average density of those shi and machi is 1203 km<sup>2</sup>, on the contrary the average of remaining machi and mura is 133 km<sup>2</sup>.

#### Representation of urban area

Urban areas are measured on the topographic map of 1 : 50,000 or land use map of the same scale. Urban areas of cities or conurbations of more than 20 km<sup>2</sup> are represented by real shape; those of less than 2,5 km<sup>2</sup> by small circulars (diameter 2 mm on the map of 1 : 800,000), and those between 2,5 and 20 km<sup>2</sup> by large circulars (diameter 4 mm). Large circulars are chosen for central cities, originating from castle towns and port towns of feudal ages. The urban areas on topographic maps include continued houses (commercial centers, residences), schools, governmental and municipal offices, factories, parks, installations of army or air force, transportation facilities, ports and so on. These are distinguished from rural settlements in line, dot or mass. It is rather difficult to border the urban area which gradually changes from the inner city to an urban fringe and hinterland. In the sample map of central Japan, the only real shape is that of the conurbation of the Tōkyō-Kawasaki-Yokohama cities. 31 shi have urban areas between 2,5 and 20 km<sup>2</sup> and 39 shi and 215 machi have less than 2,5 km<sup>2</sup>.

Urban areas occupy small areas in land form division, so it is unnecessary to take away their areas from each unit, except in the case of more than 20 km<sup>2</sup> represented by real shape on map.

#### Tabulation of population by each unit

First, population of all shi, machi and mura, the administrative boundaries of which are contained in one division completely are tabulated by figure of census as well as areas. We calculate from this the density per 1 km<sup>2</sup> of what we call "standard population density", and use it as a coefficient to divide the population of shi, machi and mura, the boundaries of which are spread over more than two land form divisions. For instance:

A mura, population 5000, is spread over X and Y division at the area ratio of 7 : 3. The standard population density of X division is 150 km<sup>2</sup>, Y division is 400 km<sup>2</sup>, population number divided into X division is calculated as follows:

$$5000 \cdot 150 \cdot 7 / 150 \cdot 7 + 400 \cdot 3 = 2333$$

and in Y division

$$5000 - 2333 = 2667$$

If we can use the dot map, it will be more simple and rapid in dividing the population number, for instance.

B-mura, population 15000, is spread over V and W division; the dot number in V division is 6 and

in W division is 9 (1 dot 1000 person). Population number divided into V division is:  
 $15000 \cdot 6/15 = 6000$   
 into W division

$$15000 - 6000 = 9000$$

#### *Population density by size group*

Population density, except urban population of each land form division, is classified according to the following 10 groups: 25 person/km<sup>2</sup>, 26—50, 51—100, 101—200, 201—300, 301—400, 401—500, 501—600, 601—700, 701—1000.

Population density range of Japan is spread widely from the lowest mountain area to the most crowded lowland, and in order to compare the differentiation on the same land form, we have to classify the density group examining the density which frequently appears on each kind of land form.

Urban population is considered to live in urban area and classified, too, as urban population density. The density of urban population shows generally 10,000—40,000 km<sup>2</sup>, in spite of the size of urban area. To the above 10 groups of density, we add two groups of urban population density, 1,000—5,000 and more than 5,000 per km<sup>2</sup>. Actually the class of 1,000—5,000 may be lacking.

#### *Reading the map*

Around the large cities we have higher density even without urban population. The hinterland of Tōkyō is large and has a very high density of 700 to 1,000 km<sup>2</sup>. Musashino upland, Tamagawa alluvial plain and Arakawa alluvial plain are there. Shōnan district along the Sagami Bay and the suburbs of Tōkyō have high density, too. The western half of Kantō Plain shows the high density of 400—900 km<sup>2</sup>. The large part of fertile Kantō Plain, the drainage of the Tonegawa and Arakawa, support this large population. On the contrary, the eastern half of the Kantō Plain has the low density of 200—400 km<sup>2</sup>. The difference is due to the contrast of land form. The East Kantō Plains consist of the continued diluvial upland and marshy lowland of the downstream Tonegawa, but the direct reason is the differentiation of land use. The north part of West Kantō Plain has prospered in sericulture since the Edo Period (1603—1867), when the reclamation of waste land on the diluvial upland was begun, but the upland of East Kantō was not reclaimed until the Meiji Era (1868—1912).

Tōkai district has a high density of 400—900 km<sup>2</sup> continuous from the Shōnan district, but the plain is narrow along the coast. It has a warm climate and the plain was reclaimed early along the most important highway, the Tōkaidō, connecting Tōkyō and Kyōto, but the reclamation of diluvial upland occurred during the Meiji Era as well as the reclamation of the upland of East Kantō. Now it is used for mandarin orange gardens and tea-gardens and shows 400 km<sup>2</sup>, the lowest density in the Tōkaidō district. In spite of their situation in those regions of higher density, the hill lands of Bōsō, Miura and Izu Penin-

sulas show the lower density of 200 km<sup>2</sup>. The plains of Ōra Nihon (along the Japan Sea) have a slightly high density compared with the East Kantō Plain and equal to the upland of Tōkaidō. The plains of West Kantō and Tōkaidō lie near the great consumption market of the Tōkyō-Yokohama district. This makes for the cultivation of vegetables, mulberries, tea, tobacco and fruits, and intensive cultivation. They can support a great agricultural population. On the contrary, the plains of Ōra Nihon are characterized by simple rice cultivation. Double cropped paddy fields are impossible in those areas because of the great accumulation of snow in winter. Then it is necessary to have larger farms per family; the surplus farmers must work away from home in another district in winter.

Basins among the mountains of the Chūbu or South Tōhoku areas show about 400 km<sup>2</sup>, but vary from a lower 200 km<sup>2</sup> district to a higher 800 km<sup>2</sup> district like the Kōfu Basin. The topography of the basin is either gently sloped fans or consists of intensively dissected fans and a few alluvial plains, and the form of agriculture brings the change of population density.

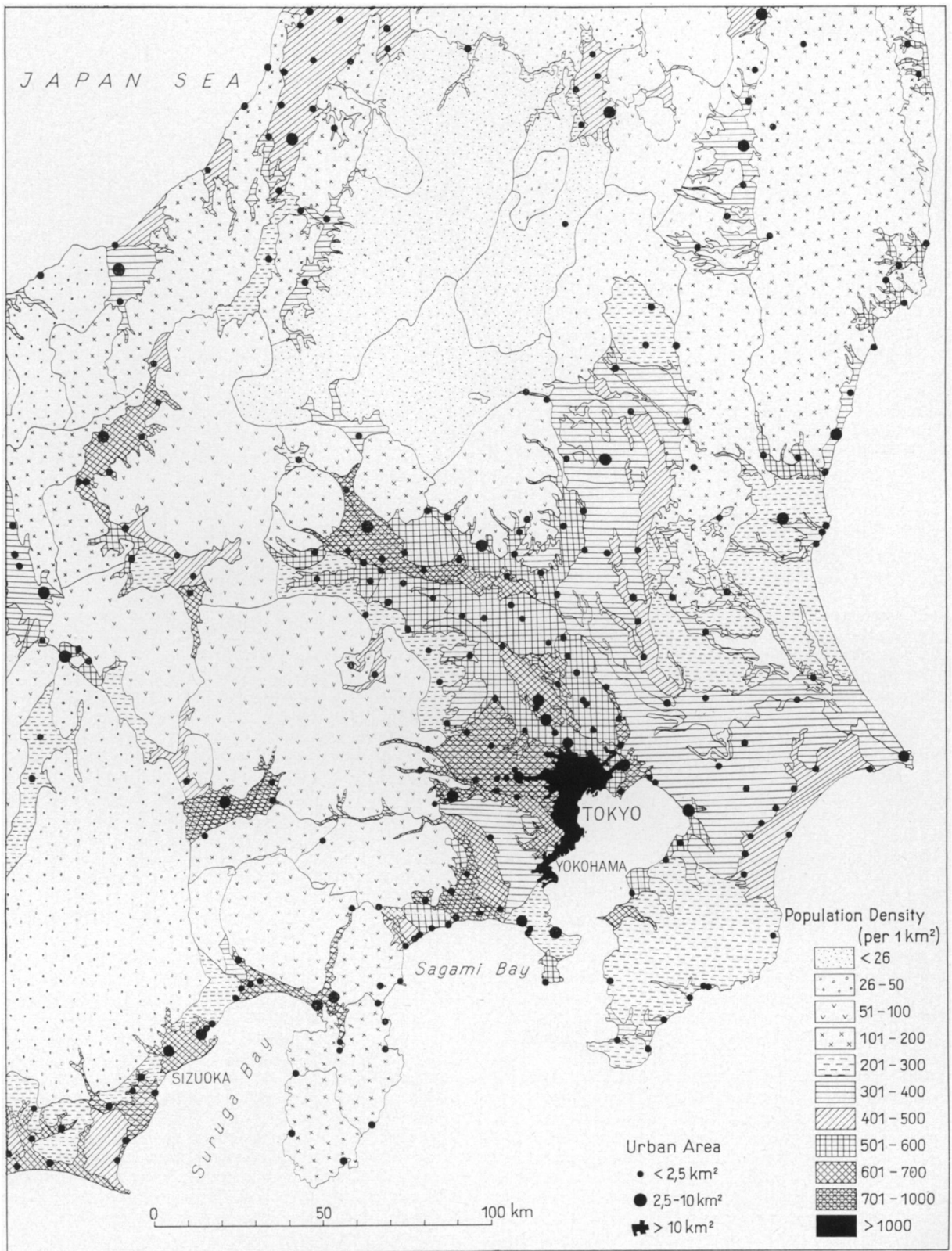
The hill land, chiefly consisting of Tertiary layer and found partially around mountains has a density from 100 to 300 km<sup>2</sup>. Small valleys dissecting the hills and the top-flatted range of hills are cultivated. The Chūbu mountain areas forming the backbone of the Japanese Islands, have a height of more than 3,000 m with steeply sloped mountains of mature stage and consist of deep, great forest area. In this mountain area which does not develop valley plains, population density is 50 km<sup>2</sup>, the lowest figure in Japan except Hokkaidō. Mountain areas from Kantō to Tōhoku are massive and steeply sloped, though they do not exceed 3,000 m. Kantō mountain area has 50—60 km<sup>2</sup>, but Tōhoku mountain area less than 25 km<sup>2</sup>. Compared with those massive mature mountains hilly low mountains such as Abukuma, Yamizo, Konuma and Tanzawa mountains have 100—140 km<sup>2</sup>, higher than the figure in high mountain areas.

Mountain areas are not used for stockfarming as in Europe, only narrow valley plains are cultivated as paddy fields. Population density of mountain areas depend on the degree of development of valley plains. Accessible small mountains near the city, such as Hakone, Akagi and Haruna volcano show an especially high density of 150 km<sup>2</sup>, because of the hot springs and other attractions for tourists.

Distribution of urban areas we can read, too. Many of them are in plains, moreover plains which have high density. They are also gathered at coastal plains and scarcely seen in central large mountain areas.

Differentiation of population density by land form division is the result of complex elements of topography, industrial forms, communication, influence of large cities and so on. It is necessary to analyse those factors, make divisions following each factor and seek the connection with population density. Here we represent a most fundamental population density map by land division.





Map. 2: Mittel-Honshû: Bevölkerungsdichte (1955)